

guest observer (GO) program on NRO/WFIRST

jason kalirai (stsci)

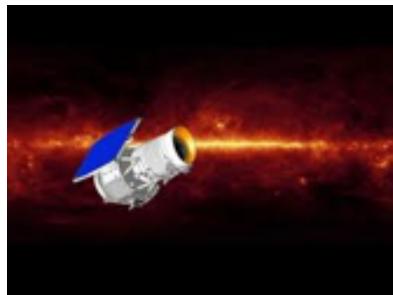
near-IR space based capabilities

instrument	telescope	pixel scale	field of view	wavelength
WISE	0.4m	2.75 arcsec	47 arcmin	3 – 28 μ m
ISO	0.6m	12 arcsec	3 arcmin	2.4 – 240 μ m
Akari	0.7m	1.5 arcsec	10 arcmin	1.8 – 180 μ m
Spitzer	0.85m	1.2 arcsec	5.2 arcmin	3 – 8 μ m
Hubble/NICMOS	2.4m	0.04 – 0.20 arcsec	0.2 – 0.9 arcmin	0.8 – 2.5 μ m
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NRO/WFIRST	2.4m	0.11 arcsec	0.3 degree	1.0 – 2.0 μm



a large telescope with a

wide-field

high-resolution camera

near-IR sensitivity

advances many scientific questions

formation models of the **solar system**

stellar **IMF**

characterization of **substellar** objects

discovery of new **planets**

theory of **star formation**

precision stellar **ages**

stellar **halos** of nearby galaxies

discovery of **dwarf satellites**

structure, morphology, colors, and evolution of **galaxies**

population of obscured and lensed **quasars**

IGM at high-redshift with quasars

faint end of the **quasar luminosity function**

strong gravitational **lensing**

the details

the near-infrared sky surveyor
arXiv:1008.3563

new worlds, new horizons in astronomy and astrophysics (2010)
http://www.nap.edu/catalog.php?record_id=12951

WFIRST DRM interim report
http://jdem.gsfc.nasa.gov/science/sdt_public/WFIRST_Interim_Report.pdf

WFIRST DRM final report
http://jdem.gsfc.nasa.gov/science/sdt_public/WFIRST_SDT_Final_Report.pdf

WFIRST one page GO science cases
<http://jdem.gsfc.nasa.gov/science/WFIRSTSurveyScience.pdf>

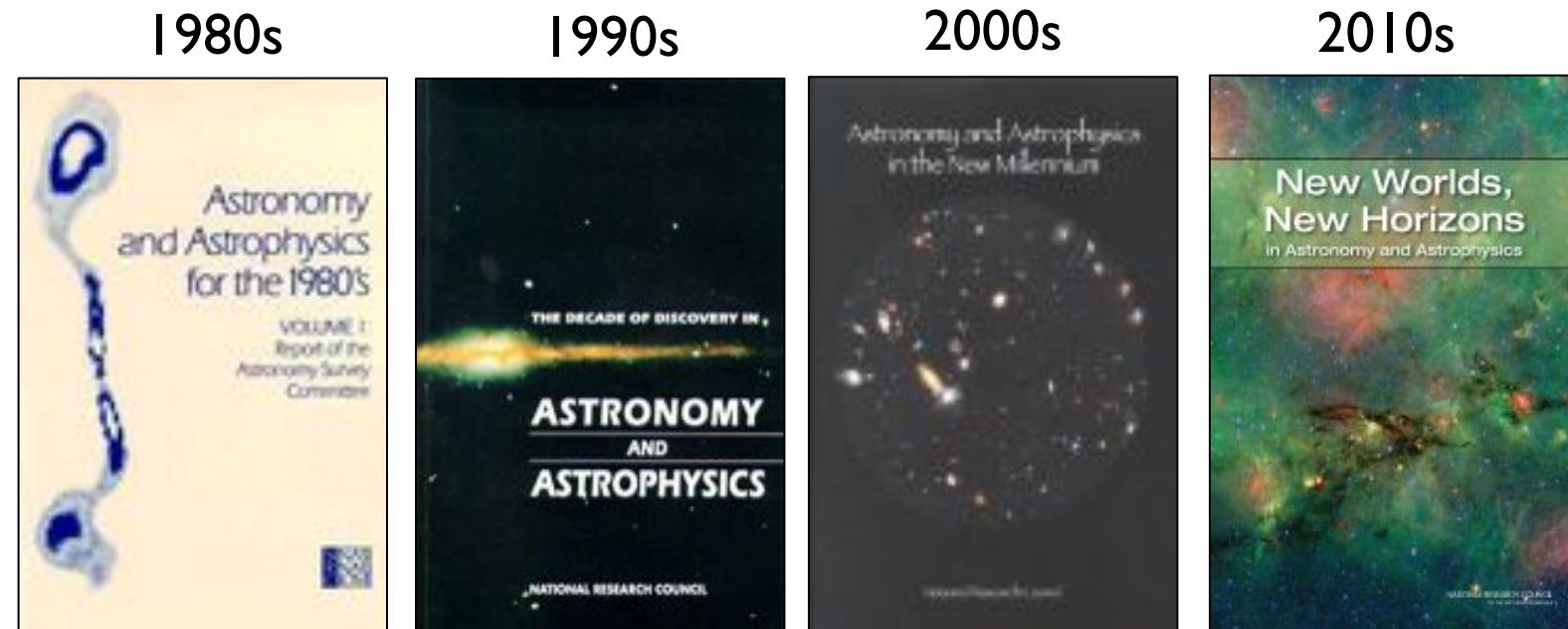
exploring the NRO opportunity for a Hubble-sized wide-field near IR space telescope
arXiv:1210.7809

why do we **need** a **large** GO program on NRO/WFIRST?

- broad **community engagement**
- tackles a **diverse** set of astrophysical questions
- open **competition** inspires **creativity**
- adapts** to changing astrophysical paradigms
- maximizes synergies with **future telescopes**
- ensures long-term scientific **discovery potential**
- continues a legacy model for **success**

NASA's great observatories

top priority missions from the US decadal surveys all address wide-ranging scientific questions

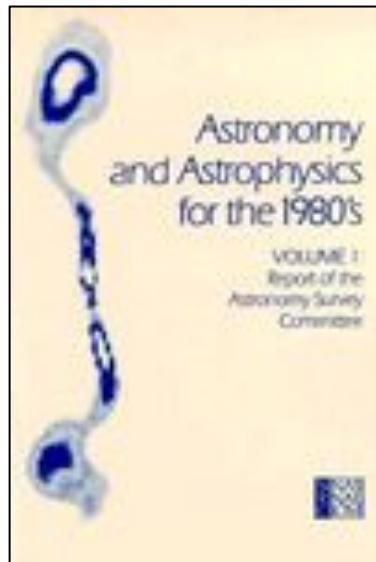


- ↓ Hubble Space Telescope (completion)
↓ Compton Gamma Ray Observatory (completion)
↓ Chandra X-ray Observatory (new)
- ↓ Spitzer Space Telescope
↓ James Webb Space Telescope
WFIRST

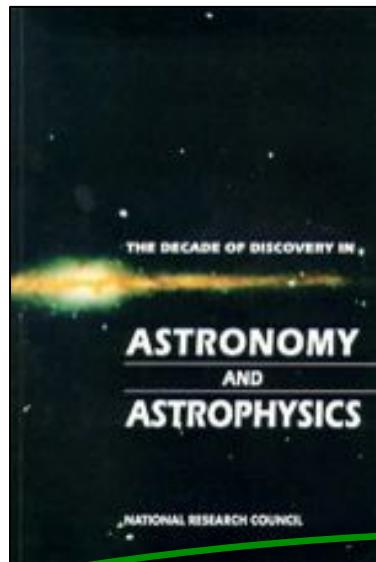
NASA's great observatories

top priority missions from the US decadal surveys all address wide-ranging scientific questions **through a model that is highly GO driven**

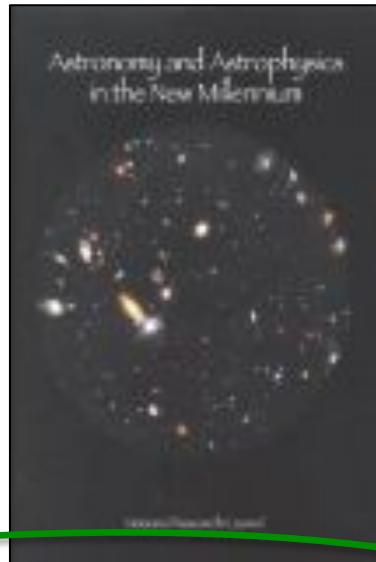
1980s



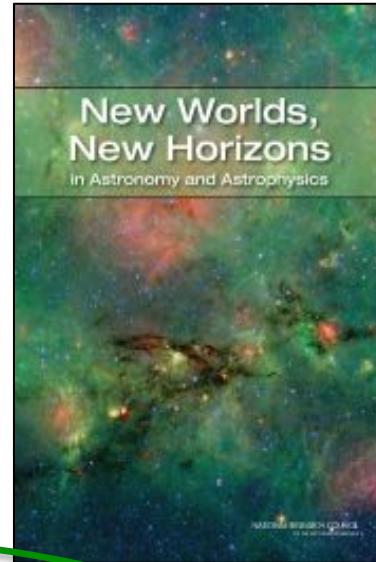
1990s



2000s



2010s



- Hubble Space Telescope (completion)
- Compton Gamma Ray Observatory (completion)
- Chandra X-ray Observatory (new)

Spitzer Space Telescope

James Webb Space Telescope

WFIRST

growing interest in high-res near-IR imaging

Hubble's approved programs

instrument	mode	% cycle 18	% cycle 19	% cycle 20
ACS	imaging	8.9	20.5	14.1
ACS	spectroscopy	0.0	0.0	0.1
COS	imaging	0.0	0.0	0.4
COS	spectroscopy	23.1	17.7	18.6
STIS	imaging	5.2	3.4	2.4
STIS	spectroscopy	21.0	18.8	7.2
WFC3/UVIS	imaging	14.9	19.0	26.8
WFC3/UVIS	spectroscopy	0.0	1.2	0.0

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WFC3/UVIS	spectroscopy	0.0	1.2	0.0
WFC3/IR	imaging	6.8	14.5	24.9
WFC3/IR	spectroscopy	19.9	3.6	5.5

WFC3/IR is now 30% of hubble's prime orbits

Hubble today

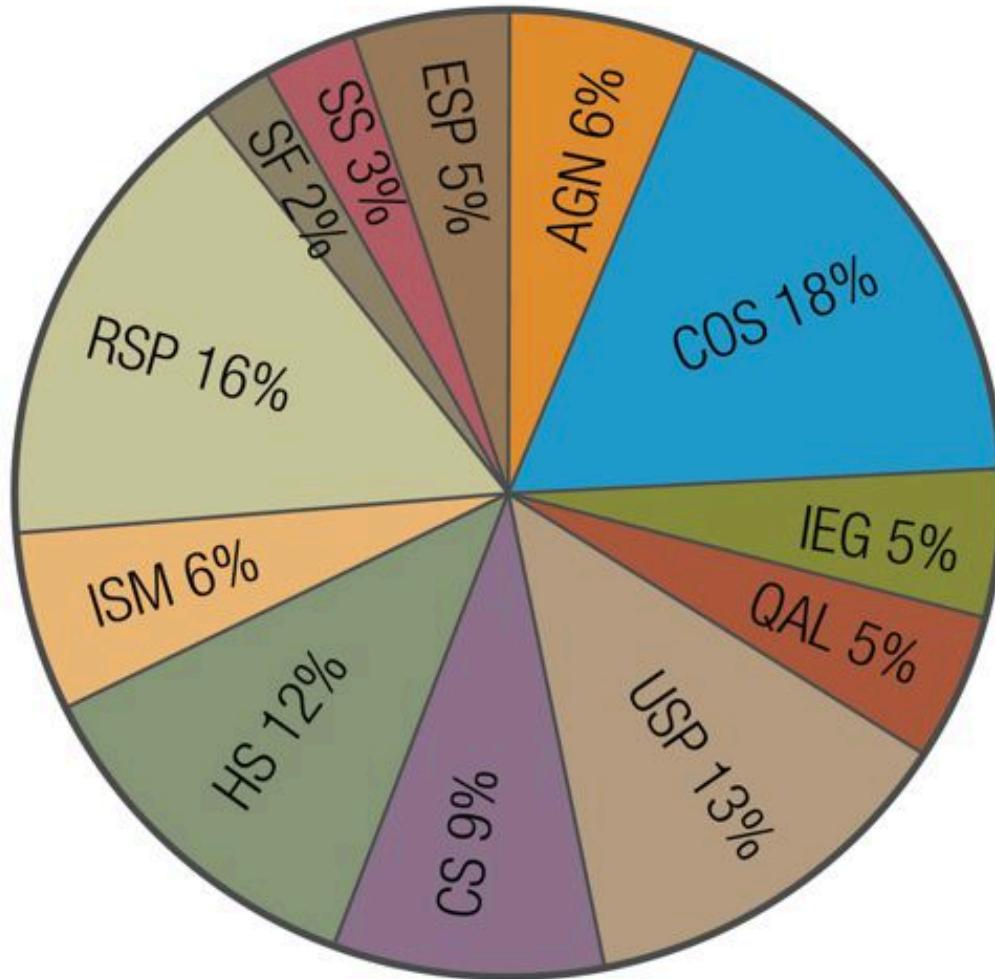
3923 authors in 2011 on published papers based on Hubble data

Hubble received >1000 science proposals in 2012;
more than in any of the past 5 years



GO science – balanced interests on a 2.4m

Hubble approved programs (cycle 20)



AGN: active galactic nuclei

COS: cosmology

IEG: ISM in external galaxies

QAL: quasar absorption lines

USP: unresolved stellar pops

CS: cool stars

HS: hot stars

ISM: ISM & circumstellar matter

RSP: resolved stellar pops

SF: star formation

SS: solar system

ESP: extra solar planets

three keys to **SUCCESS**

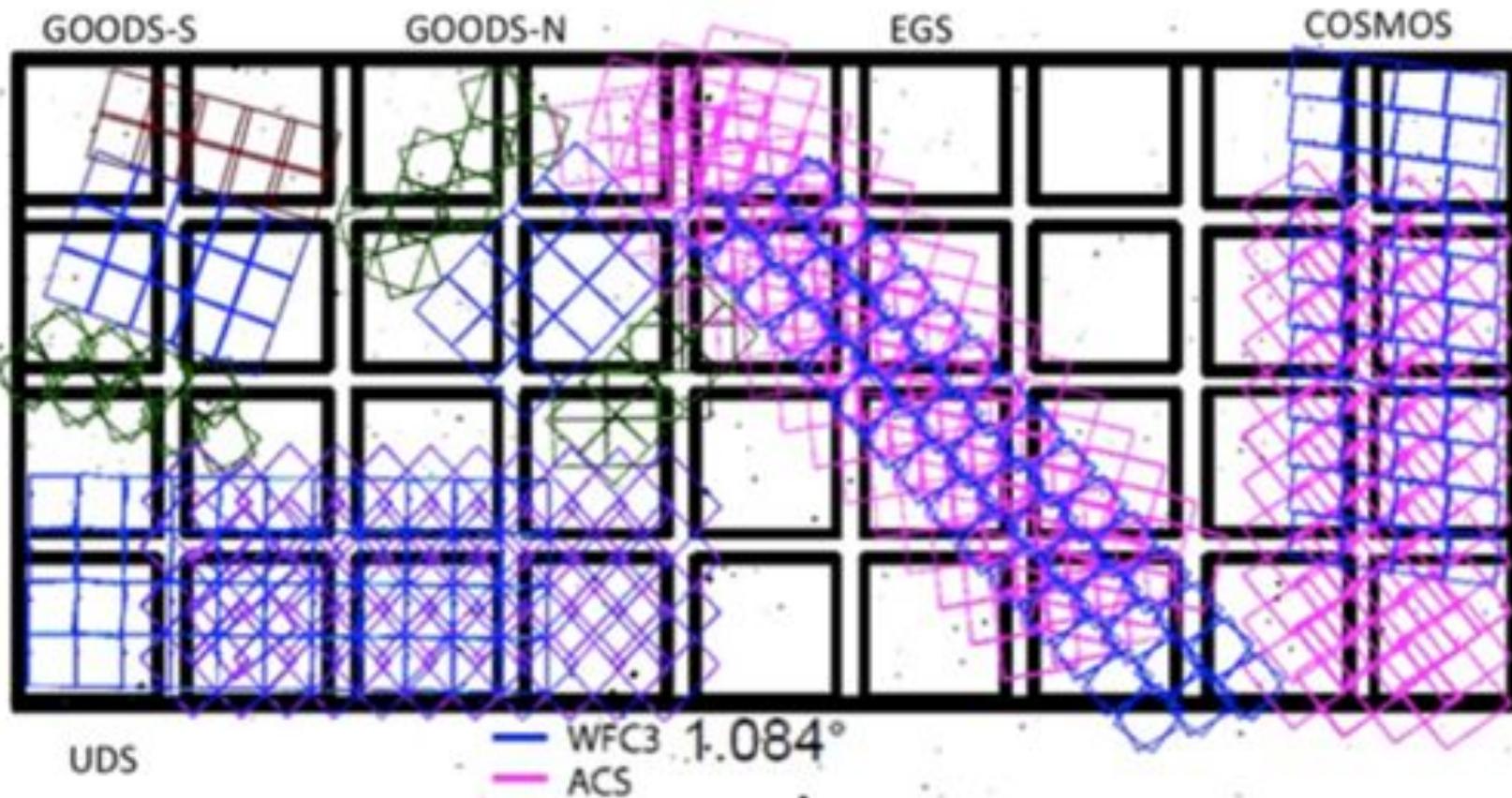
program selection by a **peer-review TAC**

high-level **data products** and **archiving**

grant funding tied to observing time

telescope longevity through **servicing**

many Hubble programs are **large**,
because of the **small** field of view



WFIRST DRM2 field of view

ra=10.6848, dec=41.269, radius=95.00 arcmin N

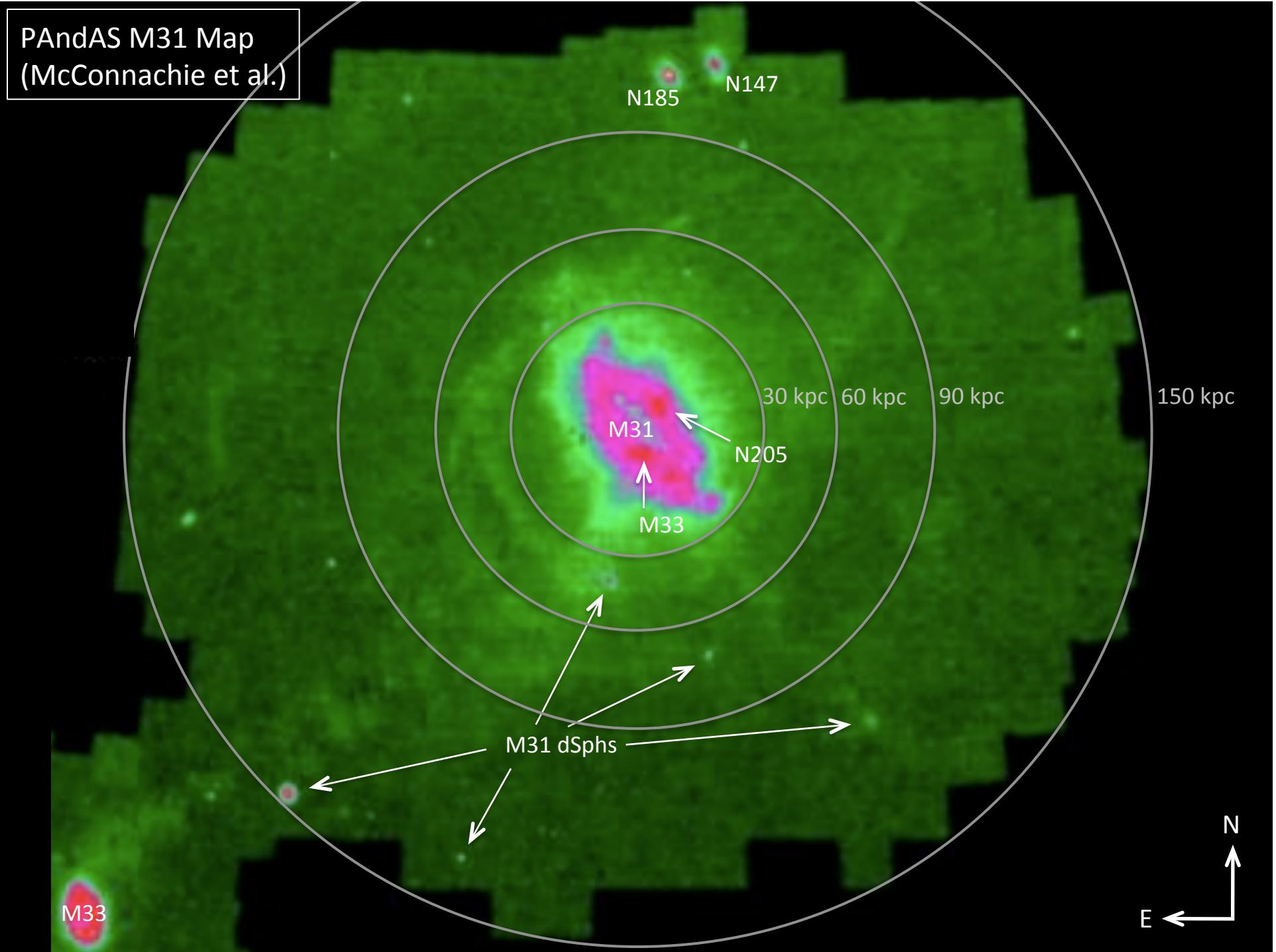
20'

E

W

ra: 10.5362 dec: 41.9623

S





nathan smith (uc berkeley) and the Hubble heritage team

ra=161.2833, dec=-59.868, radius=180.00 arcmin

1deg

E

W

S

ra: 165.6035 dec: -59.5176



ra=161.2833, dec=-59.868, radius=180.00 arcmin

1deg

E

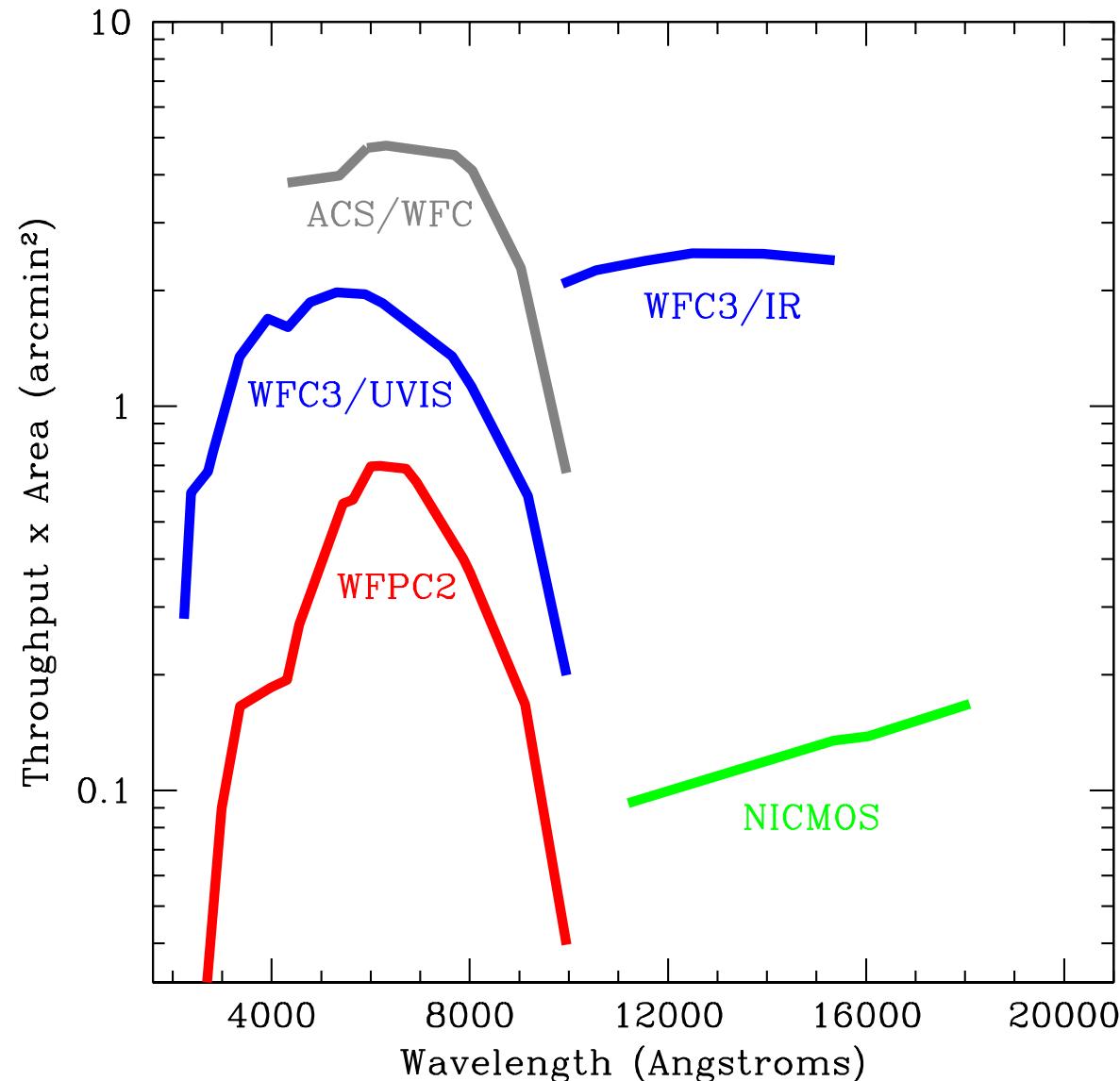
W

S

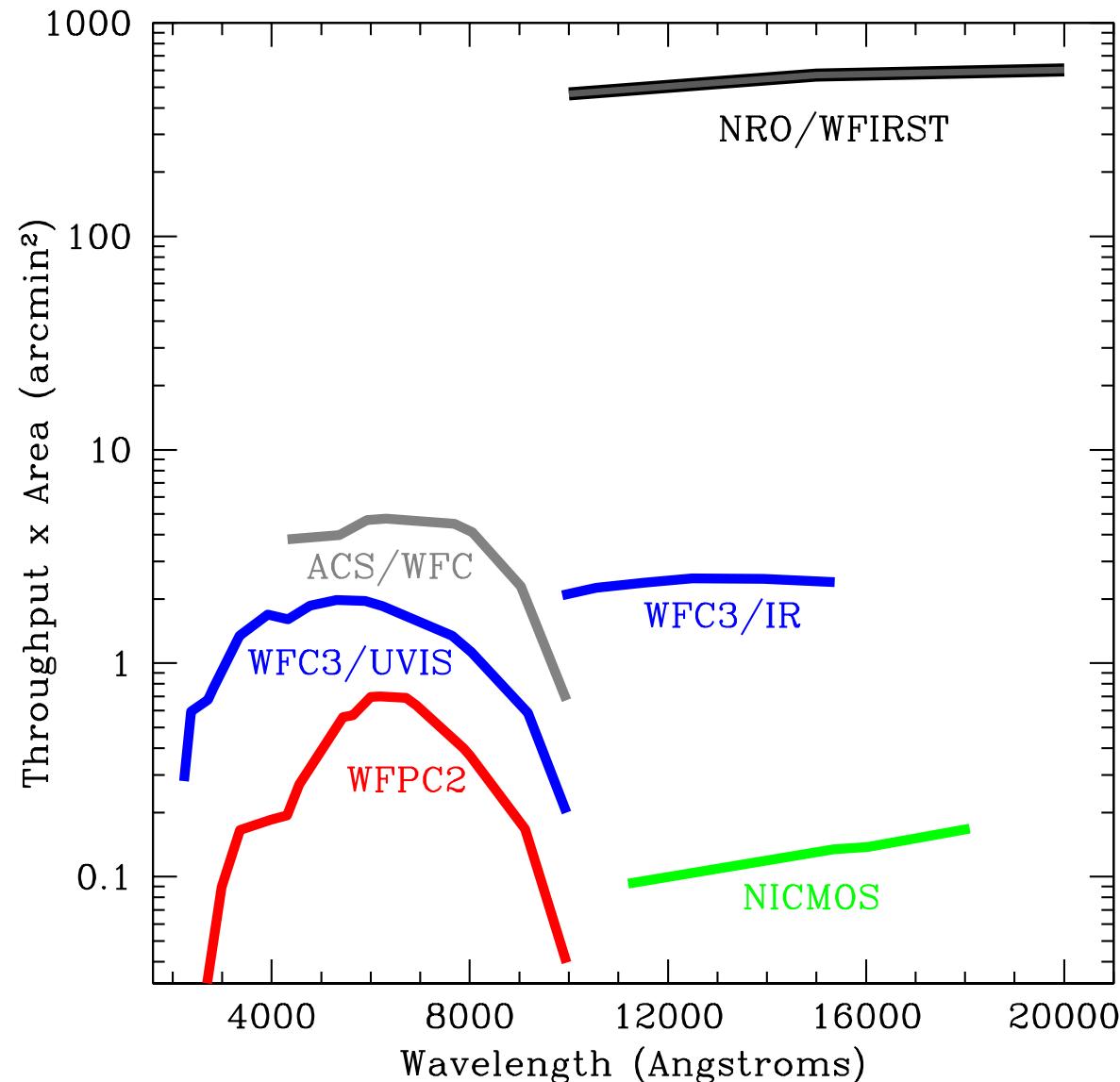
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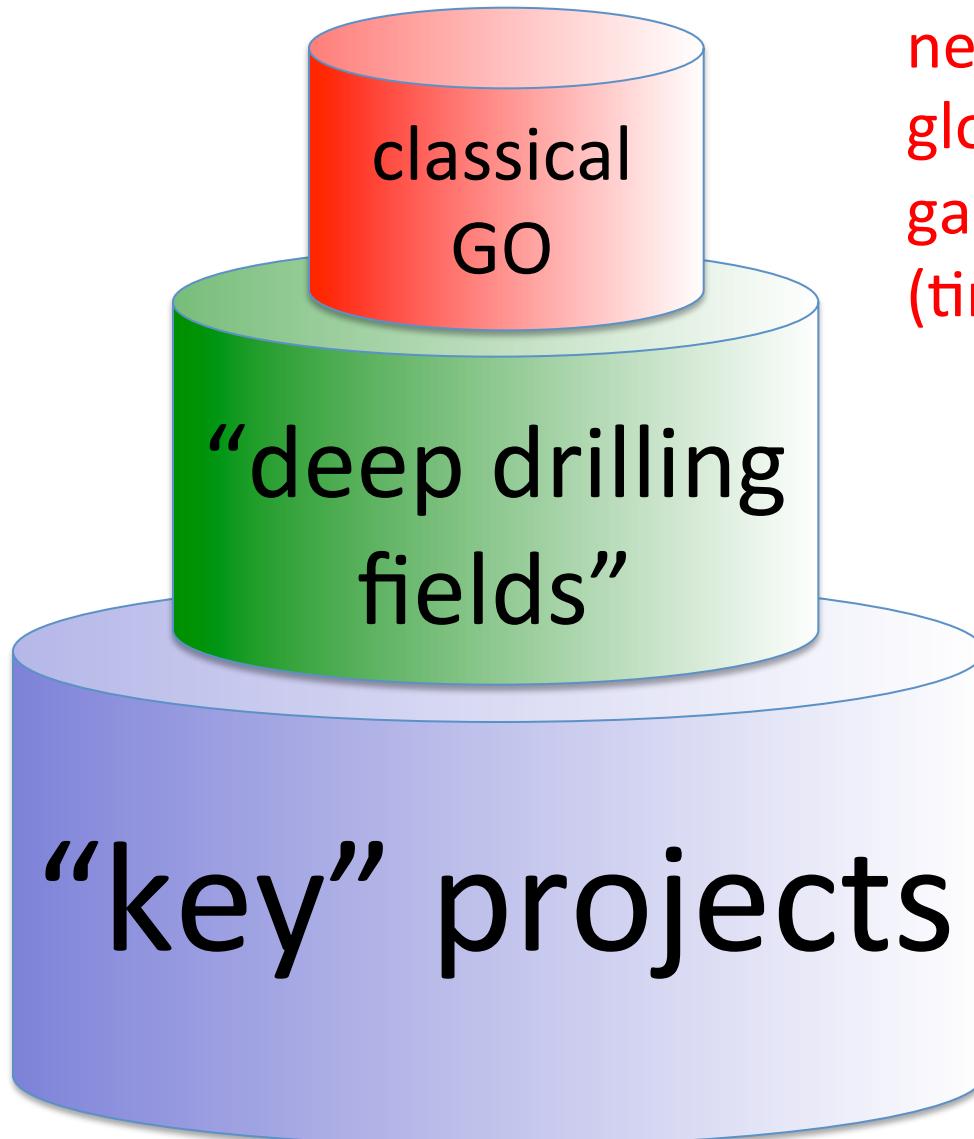
“survey discovery efficiency”



“survey discovery efficiency”



a model for a large field of view instrument



examples

nearby star forming regions

globular clusters

galaxy clusters

(time domain – LSST follow up)

LMC, SMC, local group galaxies

nearby (e.g., Virgo) clusters

GOODS, COSMOS, EGS, etc.

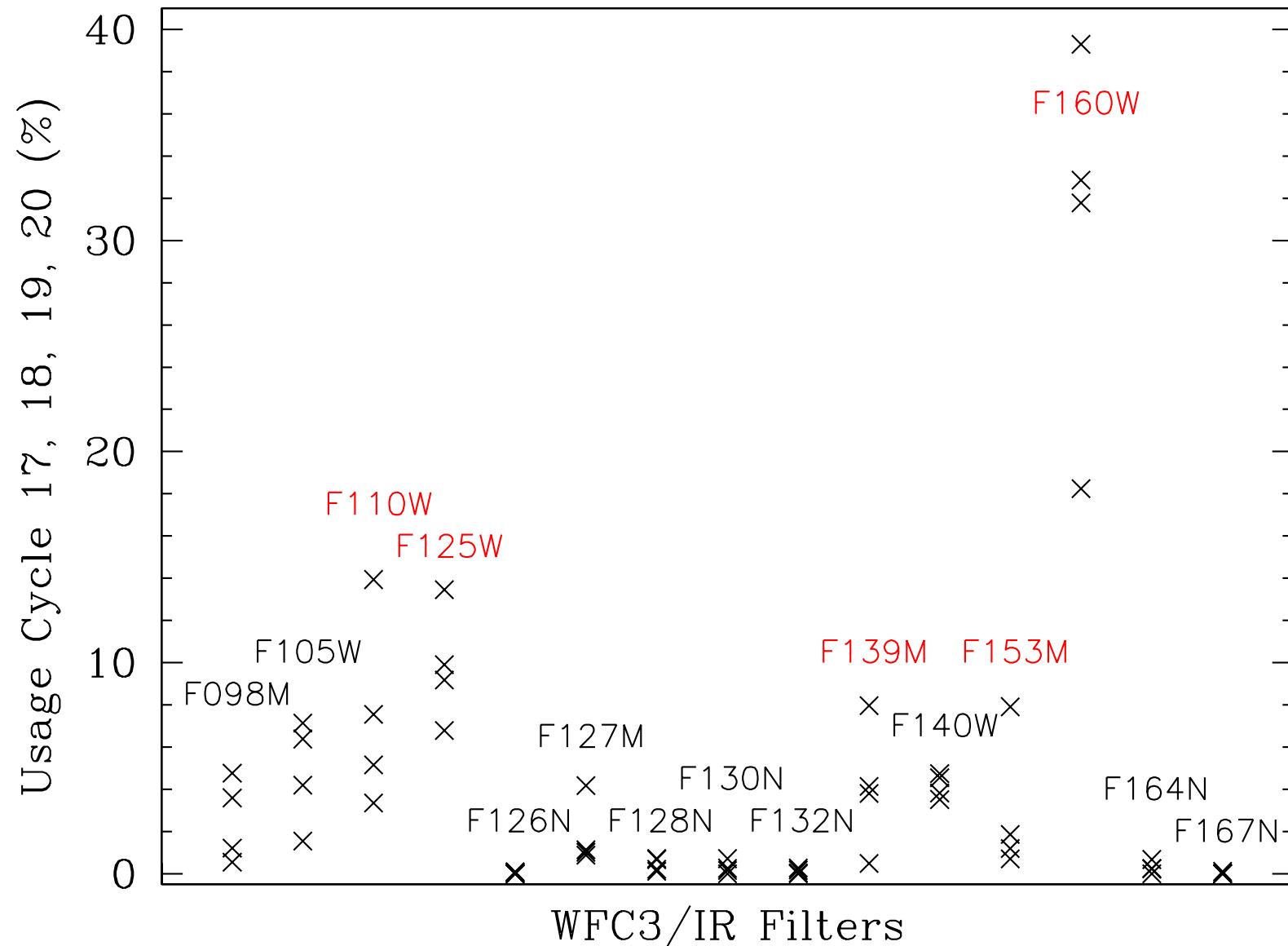
planetary exploration program

IR map of the Milky Way disk

supernova survey

dark energy survey

Hubble GO demand goes beyond YJH



summary – rationale

NRO/WFIRST needs a large GO program

consistent with the Decadal; EOS panel “embraced the notion that the GO science was the key feature of the WFIRST program” (Dressler – Princeton Meeting)

broad community engagement

proven record of maximizing scientific impact and productivity of space observatories

ensure greatest chance of driving public engagement

summary – science return

NRO/WFIRST needs a large GO program

refereed science papers (2005 – 2007)				
telescope	2005	2006	2007	sum
Chandra	509	550	489	1548
Hubble	675	688	723	2086
Spitzer	158	344	503	1005
sum	1342	1582	1715	4639

sembach et al. astro2010 – the value of observatory-class missions

Hubble + Spitzer + Chandra in 2008

1.75 press releases **per month**

9 media reports (excluding internet) **per day**

>100 website page views **per minute**

summary

GO program driven by
survey **discovery** efficiency

not just information, but **information content**

field of view is already a breakthrough

maximize pixel count, enable **new** information
over Hubble

the 2.4m standard by which we will be judged

1 Nobel prize

10 redshift of most distant galaxy candidate

100 graduate students supported each year

1,000 science proposals received each year

10,000 refereed scientific papers

100,000 citations received in past two years

1,000,000 observations



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